DIY

Worthwhile projects you can build on your own

40/80 cobra linear-loaded dipole

Have you wanted to work 80 meters, but just don't have the space for a 133-foot wire, or aren't allowed to install a tall vertical antenna on your roof? This design will work 80 meters but is only 40 feet long, which can fit in an attic, between trees, or on your vinyl or wooden fence. The term "cobra" in the title comes from the fact that the 60-foot wire on each side is "linearly loaded," or snakes around to wrap down to 20 feet long.

The design for this antenna was adapted from one by Charlie Davy MØPZT, but made for coaxial cable instead of ladder line. The adaptation required the addition of a *1:1 current balun*, which is where we'll start.

Parts list

One toroidal FT240-31 ferrite core

120 feet 14 AWG stranded wire

Two 14 AWG #8 stud ring terminals

One 14 AWG #4 stud ring terminal

Two #8 screws, wing nuts, washers, split washers

One 4.7″ x 3.2″ x 2.6″ enclosure

Two dogbone insulators

One SO-239 bulkhead connector

72 inches of 22 AWG zip wire pair

One 1-½″ x 3/16″ eye bolt

4 each M3 screws, split washers, nuts

One 1-3/8″ x 2-7/8″ fiberglass screen

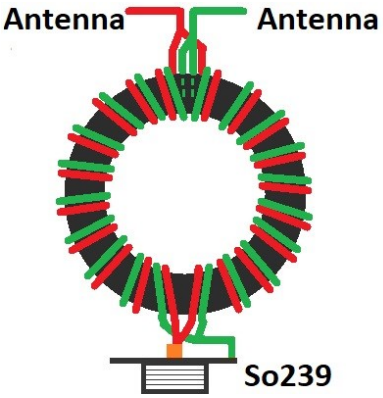
One ½″ 10-foot PVC pipe

Zip ties, hot glue and gun, Super Glue™

Construction

The diagram to the right shows what we're trying to accomplish. The purposes of this design are to a) maximize common-mode current reduction, b) minimize losses, while c) maintaining a 50-ohm impedance on both ends of the balun d) for a wide range of frequencies e) on 100 watts of transmit power.

Secure one end of the 22 AWG wire pair to the toroid with a small zip tie. Wrap the zip wire around one half of the toroid ten times, as shown:



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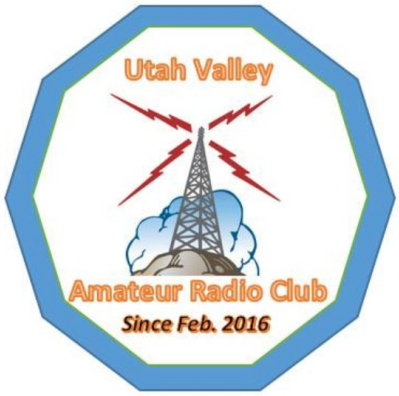
Repeat this on the other half, but in an exact mirror image of the first. This way, the red wire is on the right with the first half, and on the left with the second half. It's not necessary to wind the wires perfectly straight on every turn; close enough will be good enough. The main thing you're striving for, is to wrap each wire such that it's about as tight on the toroid as you can get it, with no overlap by any of the wires.

For reference, let's call the ends of the wires at the top of these photos the ***antenna end***, and the other end the ***transceiver end***.

Strip all eight wires. Solder the two red wires of the antenna end to a #8 ring terminal, and solder the two black wires of the same end to another #8 ring terminal. Solder the two black wires of the transceiver end to a #4 ring terminal and solder the two red wires of the same end twisted together. Set the coil aside for now.



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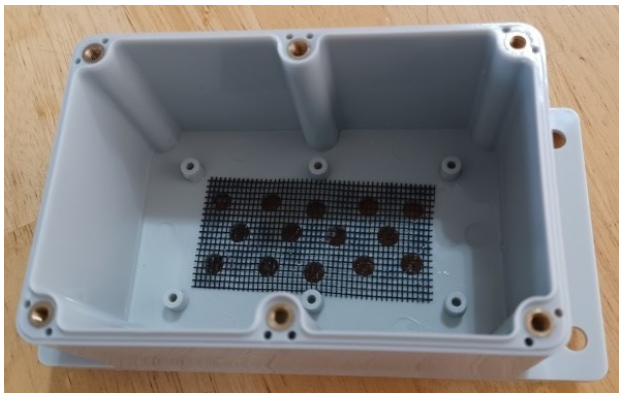
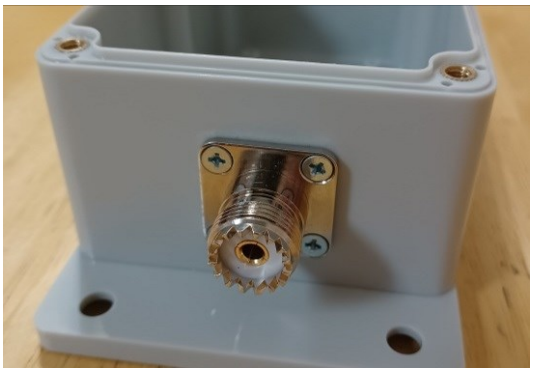
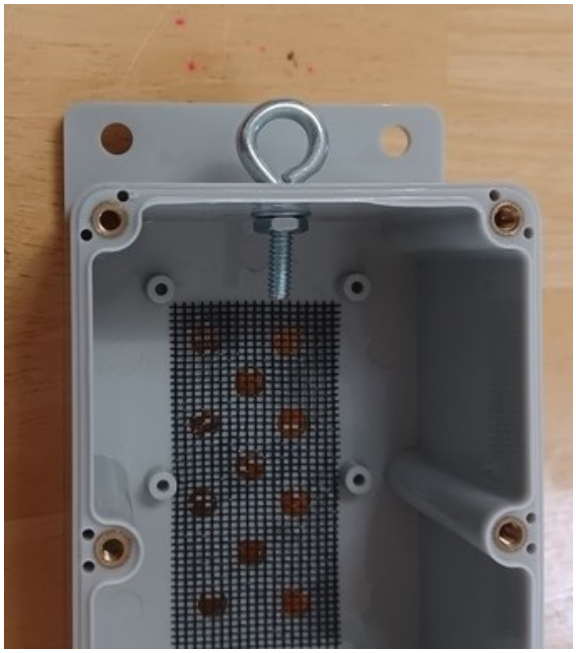
Enclosure assembly

Drill eleven to fourteen ¼″ holes in the back of the enclosure, for ventilation. Cover the holes by super-gluing the fiberglass screen over them on the inside, to prevent insects and debris from entering the enclosure.



Drill a ½″ hole in the enclosure at one end I'll call the ***balun bottom***. Place the solder cup end of the SO239 bulkhead into the ½″ hole on the outside of the enclosure, and using the four mounting holes of the bulkhead as a template, drill a 1/8″ hole for each mounting hole. Assemble the bulkhead onto the enclosure using the M3-0.5 mm hardware.





Drill a 3/16″ hole in the ***balun top***, about 1-¼″ from the back of the enclosure. Install a flat washer onto a 3/16″ eyebolt, and slip the eyebolt assembly through the hole. Secure the eyebolt with a split washer and another nut. This eyebolt can be used to hang the balun and relieve some of the strain on the wire elements due to the weight of the balun and the coax.

Drill two 3/16″ holes on opposite sides of the enclosure about an inch below the balun top (the end opposite that of the bulkhead connector). For each side, install a #8 machine screw through one of the #8 ring terminals of the coil antenna end, screw on a nut, then a flat washer, then insert the screw assembly through the 3/16″ hole from the

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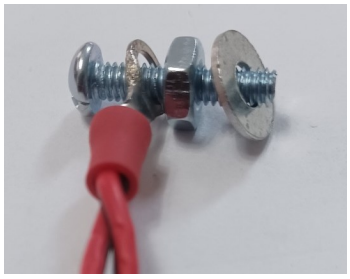
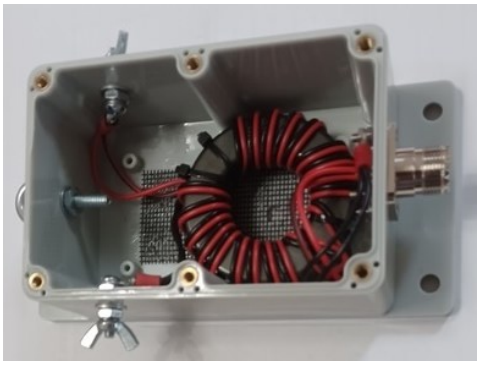
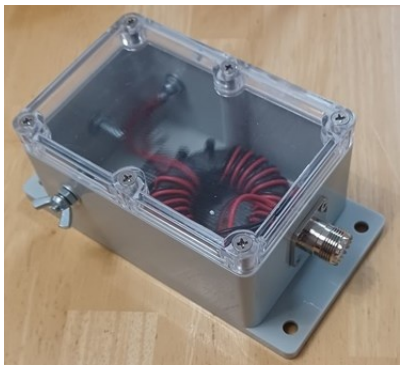
inside. Install another flat washer, nut, and wing nut onto the same machine screw on the outside of the enclosure.



Severed PL-259 connector used as a heat sink

Plug a PL-259 connector into the SO239 bulkhead, for a heat sink. If you don't plug in a connector, soldering the cup in the rear of the bulkhead can get hot enough to melt the dielectric, especially if you're using a low-wattage (under 60 watts) soldering iron. At the transceiver end of the wired toroid, lay the coil comfortably into the enclosure and solder the two red wires to the center soldering cup of the bulkhead. Bolt the #4 ring terminal of the two black wires to one of the M3-0.5 screws of the bulkhead.

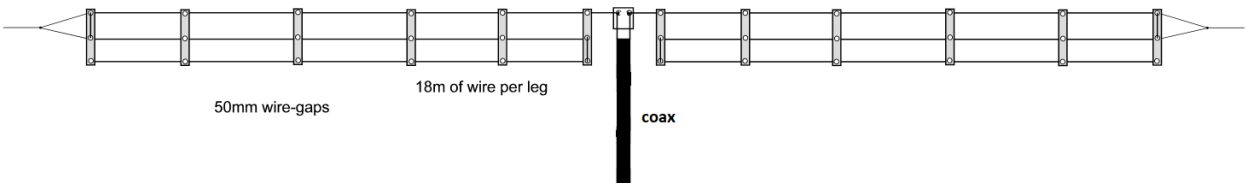




Secure the coil to the inside of the enclosure, if you feel it's necessary. Install the enclosure cover, and the balun construction is complete.

Element assembly

The following illustration depicts our goal. The idea is to thread 60 feet of wire ***on each side*** through short PVC tube sections, to maintain their shapes and distances.



Clean the ½″ PVC pipe and cut twelve 5″ sections. In each section, drill two 3/16″ holes in the

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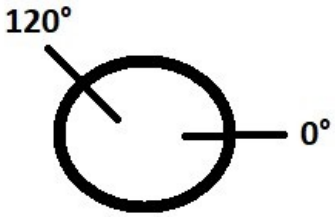
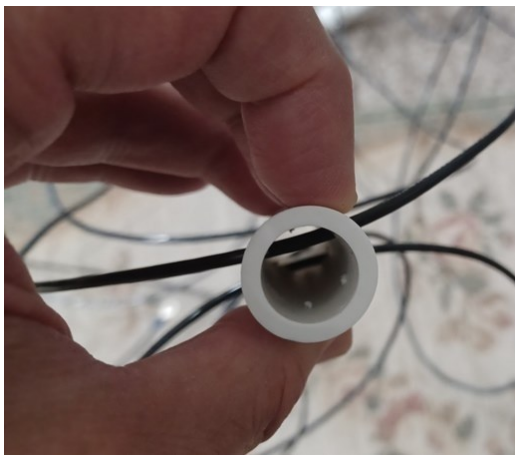
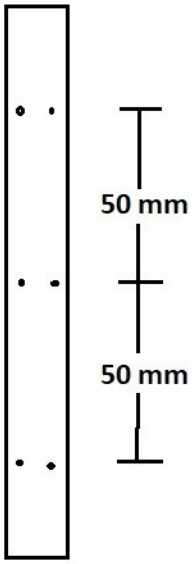


PVC spreader with two holes for stability



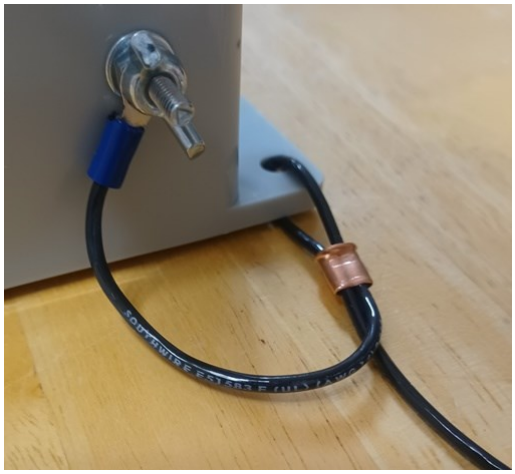
middle of the tube, at 0˚ and 120˚ angles, looking down into the tube. Repeat this for two more holes 50 mm from the middle holes toward one end, and two more holes 50 mm toward the other end.



Cut two 60-foot lengths of the 14 AWG stranded wire, and thread the wire through each set of two holes, as shown by the lines in the figure to the left, and the photos below it.

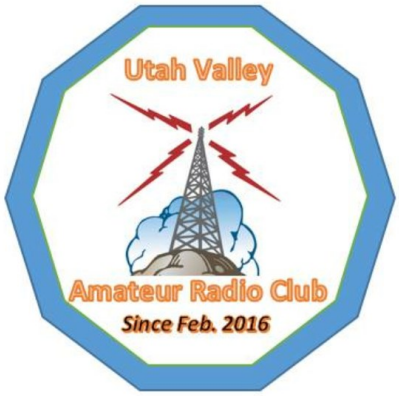
Slip the balun end of each antenna element wire through a crimp sleeve, through the enclosure external mounting hole, then back through the crimp sleeve. Solder a #8 ring terminal to that end, and secure the ring terminal to the #8 machine screw by the wing nut on the side of the balun. Ensure the crimp sleeve allows for enough wire room to keep the strain off the ring terminal, then crimp the sleeve. Repeat all this on the other side. Then, slip the antenna wire end opposite the balun end through a dogbone insulator and tie it off.

Testing the antenna



To test the 80-meter cobra antenna, mount it flat-top (horizontally), with the coax hanging straight down from the balun. It's best to keep the antenna at least 40 feet off the ground during use, but during testing you might be able to get away with raising it only 16 feet up, which will affect the feed point impedance, but might be good enough for our demonstration.

I had to keep the bottom row of the elements stretched tight by some paracord all the way across, to prevent the wires from bunching and coiling. Once I mounted the antenna between a couple of masts, I connected my Icom IC-718 and got on the air. I could hear many stations, and ended up making a contact with W6WWW in Ft. Myers, Florida. I gave him a 33 report, but he only gave me a 31. Since he was on a pair of HamSticks, that's not surprising. At any rate, it looks like it works. Just for grins, I tried it on



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20 meters, and it happened to tune up nicely there.

You can place this balun outside, even in the rain. Be sure to wrap your coax connector with silicone seal, to keep moisture from entering your coax at that junction. To make it completely waterproof, you should cover the SO-239 bulkhead inside the enclosure with hot glue or similar. The following shows the finished antenna, mounted flat-top 18 feet up:

This antenna was not an easy build; in fact, it was kind of a pain in the neck, and required a lot of time a patience. The balun was not difficult, but took time. Pulling the wire through the spreaders just right took way longer than it should have. In the end, the cobra linear loaded dipole antenna was worth the trouble, for a shortened version of an otherwise large antenna.

Summary

The cobra antenna is a limited-space version of a dipole antenna, with its element wires folded back onto itself in an RF-constructive fashion. The major effort for its construction is the 1:1 current balun, to reduce the common-mode current that would otherwise likely be picked up by the coax and brought into the shack. However, the PVC sections make this antenna rather bulky, and I'm sure I could have selected something less awkward to make the spreaders, but the pipe was inexpensive and easy to drill.

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